

1 **Fruit and vegetable intakes, sources and contribution to total diet, in very young**  
2 **children (1–4 years): the Irish National Pre-School Nutrition Survey**

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## 19 **Abstract**

20 Although the importance of fruit and vegetable (F&V) intakes in the prevention of chronic  
21 diseases is well established, there are limited data on intakes in very young children. This  
22 paper estimates F&V intakes and sources and the contribution to the total diet using data  
23 from the National Pre-School Nutrition Survey, a nationally representative sample (n=500) of  
24 Irish children aged 1–4 years. A 4-day weighed food record was used to collect food intake  
25 data. Of 1652 food-codes consumed, 740 had a fruit/vegetable component. The percentage of  
26 edible fruit and/or vegetables in each food-code was calculated. Intakes (g/d), sources (g/d)  
27 and the contribution of F&Vs to the weight of the total diet (%) were estimated, split by age.  
28 All children consumed F&V. Intakes of total fruit, in particular fruit juice, increased with age.  
29 The contribution to total fruit intake was discrete fruit (47–56% range across age), 100% fruit  
30 juice, smoothies and pureés (32–45%) and fruit in composite dishes (7–13%). Total vegetable  
31 intake comprised of discrete vegetables (48–62% range across age) and vegetables in  
32 composite dishes (38–52%). F&V contributed on average 20% (15% fruit; 5% vegetables) to  
33 the weight of the total diet and was <10% in 61 children (12%). F&V contributed 50% of  
34 vitamin C, 53% of  $\beta$ -carotene, 34% of dietary fibre and 42% of non-milk extrinsic sugar  
35 intakes from the total diet. F&Vs are important components of the diet of Irish pre-school  
36 children; however, some aspects of F&V intake patterns could be improved in this age-group.

37 Key words: children; fruit; vegetables; juice; dietary intake; survey; guidelines; pre-school;  
38 composite dishes

## 39 **Introduction**

40 Early childhood is a pivotal time in the development of food preferences and as such an  
41 opportunity to foster the development of healthy eating practices. Fruit and vegetable intakes  
42 play an important role in the prevention of chronic diseases <sup>(1)</sup> and obesity <sup>(2)</sup> and to halt the  
43 escalating prevalence of both, fruit and vegetable consumption should be encouraged from an  
44 early age. There are however limited data on fruit and vegetable intakes in very young  
45 children.

46 The beneficial role of both quantity and variety of fruit and vegetable intake has been  
47 acknowledged in disease prevention in adults <sup>(3)</sup>. There are also unresolved questions as to the  
48 health outcomes associated with fruit juice intake <sup>(4;5;6)</sup> and concerns about sugar intake  
49 including that from fruit <sup>(7;8)</sup>. Thus, it is important to characterise fruit and vegetable intake by  
50 identifying the dietary sources and estimating the contribution to nutrient intakes.

51 Currently, there are no established quantitative guidelines for fruit and vegetable intakes for  
52 very young children in Ireland or in many other countries. However there are number of  
53 evidence based resources available including “The Infant and Toddler Forum” <sup>(9)</sup>. It is  
54 generally acknowledged that due to the volume that a young child can consume, 400g a day  
55 or 5 (80g) portions per day, the guideline for those aged  $\geq 5$  years in Ireland <sup>(10;11)</sup> and the  
56 WHO population goal <sup>(1)</sup>, is not appropriate. Evaluating the proportion of the diet that is  
57 comprised of fruit and vegetables in very young children could inform whether public health  
58 intervention such as the development of an age specific guideline is necessary. The aim was  
59 to estimate fruit and vegetable intakes and identify the sources and contribution to the total  
60 diet in Irish preschool children aged 1–4 years using data from the National Pre-School  
61 Nutrition Survey (NPNS).

## 62 **Methodology**

### 63 *Survey design and population*

64 The National Pre-School Nutrition Survey (NPNS), a nationally representative dietary survey,  
65 was carried out by the Irish Universities Nutrition Alliance between October 2010 and  
66 September 2011 to establish a database of habitual food and drink consumption in a  
67 representative sample of Irish children aged 1–4 years.

68 500 (boys 251, girls 249) pre-school children, aged 12 to 59 months inclusive, were recruited  
69 from a database of children compiled by ‘eumom’ (an Irish parenting resource;  
70 [www.eumom.ie](http://www.eumom.ie)) or from randomly selected childcare facilities in selected locations. While  
71 this facilitated a representative sample of the population of the Republic of Ireland with  
72 regard to age, sex and residential location, the sample contained a higher proportion of  
73 children of professional workers and a lower proportion of children of skilled manual  
74 workers than the general population <sup>(12)</sup>.

75 Children and their families were visited in their own home by a research nutritionist. 4-day  
76 weighed food records were used to collect food intake data. Training in completion of the  
77 food record was given to primary care-givers and a brief set of instructions on a laminated  
78 sheet was provided to accompany the child and food record when in the care of others. The  
79 food records benefited from a large amount of researcher/participant interaction allowing for  
80 detailed training of the participants and clarification of recorded data where necessary. All  
81 participants completed records over a continuous four day period, including at least one  
82 weekend day. Food intake data were converted to nutrient intakes using UK and Irish food  
83 composition data <sup>(13; 14)</sup>.

84 This study was conducted according to the guidelines laid down in the Declaration of  
85 Helsinki and ethical approval was obtained from the Clinical Research Ethics Committee of  
86 the Cork Teaching Hospitals, University College Cork. Written informed consent was  
87 obtained from parents/guardians. A detailed description of the survey methodology is  
88 available at [www.iuna.net](http://www.iuna.net).

### 89 *Fruit & vegetable intake*

90 1652 different food-codes were consumed on the NPNS, of these 740 had a fruit and/or  
91 vegetable component. These included discrete fruit and vegetables and fruit and vegetables  
92 contained in composite foods and dishes. The percentage of fruit and/or vegetables in each of  
93 these food-codes was estimated using standard recipes from the UK food composition  
94 database <sup>(14)</sup>, and from participants' food diaries, and manufacturers' product information.  
95 Calculations were included to remove inedible or un-consumed portions e.g. cores, uneaten  
96 peel. The effects of concentration, e.g. in the case of tomato purée, were also accounted for.  
97 Vegetables included: the edible parts of plants commonly consumed as vegetables; foods used  
98 as vegetables such as green pulses and sprouts, fresh sweetcorn; botanical fruits used as  
99 vegetables, such as tomatoes, peppers or cucumbers and; mushrooms and seaweed. Cereals,  
100 potatoes and other tubers, as well as dry pulses, were not considered as vegetables. Fruits  
101 included the edible part of all fruits that were fresh, canned, frozen and dried, unless they  
102 were classified as vegetables. Fruits with high energy content, such as avocados and olives  
103 were included as fruit. In calculating the fruit and/or vegetable proportion of composite foods  
104 and dishes, all dishes/foods with a fruit and/or vegetable component regardless of nutritional  
105 profile of the dish/food were included.

### 106 *Statistical analysis*

107 Intakes (g/d) and sources (g/d) were described for the total population and for consumers only  
108 using mean, median, standard deviation (SD) and % consumers. Intakes from major sources  
109 were stratified by age and the association with age assessed using ANOVA. Associations  
110 were considered significant at  $p < 0.05$ .

111 Intakes and sources were further disaggregated by age and are presented for the total  
112 population and for consumers only (Online Supporting Material Tables 1 & 2).

113 The contribution of fruit and vegetable intake to the weight of the total diet (total weight of  
114 all food and beverages in the diet) was estimated separately as the contribution of: all sources  
115 (g); discrete vegetables (g); discrete fruit (g); vegetables in composite foods and dishes (g);  
116 and fruit in composite foods and dishes (g), to the total weight of the diet (g). These were  
117 expressed as percentages and reported for the total population and by age.

118 We estimated the proportion of children with contributions of fruit and vegetables to the  
119 weight of the total diet at 4 levels:  $<10%$ ;  $\geq 10%$  and  $<20%$ ;  $\geq 20%$  and  $<30%$ ; and  $>30%$ . As  
120 the weight of fruit juice contributes disproportionately to the weight of total fruit and  
121 vegetables the proportion of children in each category of percent contribution was calculated  
122 both including fruit and vegetables from all sources and limiting the contribution of 100%  
123 fruit juice to total fruit and vegetable intake to 1 portion per day [(50-120 ml) <sup>(15)</sup>]. As food and  
124 beverage intake data were weighed and subsequently reported in grams, a 1:1 conversion of  
125 ml to g was assumed.

126 Using age appropriate portion sizes for individual fresh fruits and vegetables, dried fruit and  
127 fruit juice (derived from medians of intakes, mostly weighed) (range 14-124g) <sup>(15)</sup>, we  
128 estimated the mean  $\pm$  SD daily intake of portions of fruit and vegetables consumed from: all  
129 sources of fruit and vegetables; and all sources of fruit and vegetables limiting the

130 contribution of 100% juice to 1 portion. We reported these for the total population and by  
131 age.

132 The contribution fruit and vegetable intakes made to intake of key nutrients were estimated as  
133 mean daily intake and % contribution of total dietary intake for: total sugar, non-milk  
134 extrinsic sugars (NMES), dietary fibre, potassium, folate, vitamin C and  $\beta$ -carotene.

## 135 **Results**

136 The daily intake of fruit and vegetables in the total population and in consumers only, from  
137 all sources and disaggregated by source, are displayed in Table 1. All pre-school children  
138 consumed fruit and vegetables during the four survey days. Mean daily intake of fruit and  
139 vegetables from all sources was  $247 \pm 124$  g/d. There were more consumers of fruit (98%)  
140 than of vegetables (90%). The largest proportion (70%) of total fruit and vegetable intake  
141 (247 g/d) came from discrete fruit intake (171 g/d).

142 There were no differences in intakes by sex ( $p=0.303$ ). Intakes of total fruit were positively  
143 associated with age ( $p<0.001$ ) but there was no significant association between vegetable  
144 intake and age ( $p=0.184$ ) (Table 2). Higher intakes of total fruit in older children were largely  
145 explained by higher intakes of 100% fruit juice, smoothies and purees (Table 2). This was  
146 driven by a threefold higher intake of 100% fruit juice in those age 4 years ( $77 \pm 99$  g/d)  
147 versus those age 1 year ( $23 \pm 50$  g/d) (Online Supporting Material Table 1).

148 The sources of total fruit intake were: discrete fruit excluding 100% fruit juice, smoothies and  
149 purees (48–56% contribution to total fruit, range of contribution across age) of which bananas  
150 (14–19%) and apples (7–13%) contributed the most; 100% fruit juice, smoothies and purees  
151 (32–45%) and; fruit in composite foods and dishes (7–13%) of which beverages contributed  
152 the most (48–63%). Total vegetable intake comprised of discrete vegetables (48–62%  
153 contribution to total vegetables, range of contribution across age) of which peas, beans and  
154 lentils (11–16%) and carrots (9–15%) contributed the most and; vegetables in composite  
155 foods and dishes (38–52%) of which meat based dishes (15–30%) contributed the most  
156 (Table 2 & further disaggregation in Online Supporting Material Table 1).

157 Trends observed for intakes and sources by age in the total population were similar when  
158 examined in consumers only (Online Supporting Material Table 2).



159 Fruit and vegetables contributed 20% (fruit: 15%, vegetables: 5%) of the weight of the total  
160 diet (Figure 1). This did not vary significantly with age. The ratio of the contribution of  
161 discrete fruit and vegetables to fruit and vegetables in composite foods and dishes varied with  
162 age, with older children consuming more discrete fruit and vegetables (Figure 1).

163 Of the 500 children, 61 had fruit and vegetable intakes that contributed <10% of the weight  
164 of the total diet, 224 had intakes that contributed  $\geq 10\%$  and <20%, 148 had intakes that  
165 contributed  $\geq 20\%$  and <30% and 67 had intakes that contributed  $\geq 30\%$ . Limiting the  
166 contribution of 100% fruit juice to total fruit and vegetable intake to 1 portion per day most  
167 affected the number of children categorised as having contributions  $\geq 30\%$ . After applying the  
168 limitation, 64 children had fruit and vegetable intakes that contributed <10% of the weight of  
169 the total diet, 243 had intakes that contributed  $\geq 10\%$  and <20%, 151 had intakes that  
170 contributed  $\geq 20\%$  and <30% and 42 had intakes that contributed  $\geq 30\%$ .

171 The mean daily intake in the total population was  $4.7 \pm 2.2$  portions of fruit and vegetables and  
172  $4.5 \pm 2.0$  portions when the contribution of juice was limited to 1 portion per day. Mean daily  
173 intake of portions differed by age ( $p \leq 0.001$  when including all juice and when limiting juice).  
174 Children aged 1 year consumed the most portions per day (mean  $\pm$  SD,  $5.5 \pm 2.6$  when  
175 including all juice and  $5.3 \pm 2.3$  when limiting juice) and children aged 4 years consumed the  
176 least (mean  $\pm$  SD,  $4.3 \pm 1.8$  when including all juice and  $4.1 \pm 1.7$  when limiting juice).

177 Fruit and vegetable intakes contributed 32% (24g/d) of total sugar, 42% (24g/d) of NMES,  
178 34% (4.1g/d) of dietary fibre, 25% (449mg/d) of potassium, 18% (30 $\mu$ g/d) of folate, 50%  
179 (43mg/d) of vitamin C and 53% (1225 $\mu$ g/d) of  $\beta$ -carotene daily intakes.

## 180 **Discussion**

### 181 *Summary of findings*

182 In this nationally representative survey of pre-school children aged 1-4 years, fruit and  
183 vegetables were important foods, contributing 20% of the weight of the total diet and  
184 consumed by all children during the four days surveyed. Discrete fruit intake was the largest  
185 contributor to total fruit and vegetable intakes. Total fruit intake was higher in older children,  
186 largely driven by higher intakes of 100% fruit juice. Vegetable intakes contributed only 5% of  
187 the total weight of the diet and 10% of children consumed no vegetables during the four  
188 survey days. Composite foods and dishes were important sources of vegetables particularly in  
189 younger children in whom they contributed 52% of total vegetable intake. Mean portion  
190 intake was 4.7 portions per day. 12% of children had what could be considered a very low  
191 (<10%) contribution of fruit and vegetable intake to the weight of the total diet. F&Vs were  
192 an important source of nutrients in particular vitamin C (50% of mean daily intake),  $\beta$ -  
193 carotene (53%) and dietary fibre (34%) intakes. They also contributed 42% of non-milk  
194 extrinsic sugar daily intakes.

### 195 *Results in context*

196 To compare our findings directly with those from other studies is difficult as we have  
197 included fruit and vegetables in composite dishes, excluded inedible portions and included  
198 calculations for concentration and cooking losses. These are methodologies not routinely  
199 included in studies as they require a detailed level of data collection that is often not  
200 available. Some general comparisons can be made with surveys from the UK and US.

201 In the UK National Diet and Nutrition Survey mean intakes in 1.5-3 year olds were 106g/d  
202 for fruit, 114 g/d for fruit juice, 22 g/d for salad and raw vegetables and 48 g/d for cooked

203 vegetables including those from composite dishes, totalling a crude mean of 290 g/d <sup>(16)</sup>. This  
204 is similar to the mean intakes of total fruit and vegetables in the current study of 247 g/d.. The  
205 Feeding Infants and Toddlers Study (FITS) reported that a substantial proportion of US  
206 children do not consume any fruit or vegetables in a given day <sup>(17)</sup>. In contrast, all children in  
207 the current study consumed fruit and/or vegetables. This difference may be explained by  
208 methodological difference as FITS is based on one 24-hour recall and only included discrete  
209 fruit and vegetable intakes.

#### 210 *Contribution of composite foods and dishes*

211 The importance of composite foods and dishes in the estimation of fruit and vegetable intakes  
212 has been highlighted previously, albeit in adults <sup>(18; 19)</sup>. Our study has shown that inclusion of  
213 the contribution of composite foods and dishes is particularly important for estimating  
214 vegetables intakes in this age-group as 38-52% (range across age) of their vegetable intake  
215 was from this source. The contribution of composite foods and dishes should be included in  
216 estimating intakes for other analyses. If it is not feasible to disaggregate composite food-  
217 codes, the percentages reported here could be applied. Without accounting for this important  
218 source, intakes may be underestimated by as much as 52% in this age-group. Thus composite  
219 foods and dishes should also be considered if generating guidelines for consumption.

#### 220 *Fruit and vegetable dietary patterns and guidelines*

221 It is difficult to interpret what contribution to diet fruit and vegetable intake should make in  
222 very young children. Currently Irish food based dietary guidelines pertaining to fruit and  
223 vegetable intake are for those aged 5 years and more <sup>(10; 11)</sup>. Other countries similarly have a  
224 gap between breast/bottle feeding and weaning advice for infants and the availability of food  
225 based dietary guidelines. For example the *eatwell* plate in the United Kingdom is also aimed  
226 at those over the age of 5 years <sup>(20)</sup>. Some countries have established guidelines including

227 Australia who recommend 2-3 servings of vegetables and legumes and 0.5 servings of fruit  
228 for boys and girls aged 1-2 years and 2.5 and 1 servings respectively for 2-3 years olds<sup>(21)</sup>.  
229 To inform whether the development of age specific fruit and vegetable guidelines or public  
230 health interventions for fruit and vegetable intake in pre-school children are necessary we  
231 carried out a number of observational analyses. Areas we noted for improvement included the  
232 contribution of fruit juice to total fruit intake, the proportionally lower vegetable intakes than  
233 fruit intakes, and the very low intakes of fruit and vegetables (<10% weight) and 0 g/d  
234 intakes of vegetables in a sub-group of the population.

235 Pre-school age is an important time for establishing good dietary behaviours to carry forward  
236 into later life<sup>(22)</sup>. Previous evaluation of discrete fruit and vegetables in Irish school-age  
237 children has shown that pre-school children have a higher intake and less reliance on fruit  
238 juice than older children and teenagers<sup>(23)</sup>. Our more detailed observations compounded this  
239 finding and also provided further insight as to the evolution of dietary patterns in this age-  
240 group. The greater dependence on fruit juice as a source of fruit with increasing age noted for  
241 older children, was already evident in pre-school children. In pre-school children the total  
242 fruit and vegetable intake excluding fruit juice increased with age as did the percentage of the  
243 total diet comprised of fruit and vegetable. This suggests that the decline in intake of fruit and  
244 vegetables coincides with starting school, marking this as a point for targeted intervention.

245 The mean intake of the pre-school population was 4.7 portions a day. This is encouraging as  
246 currently the Irish child and teenager<sup>(23)</sup>, and adult<sup>(24)</sup> populations need to double their intakes  
247 to meet the 5-a-day fruit and vegetable intake recommendations<sup>(1)</sup>.

#### 248 *Fruit juice*

249 There is mixed evidence for the nutritional benefits of consuming fruit juice. In this  
250 nationally representative survey of very young children 100% fruit juice was a large

251 contributor to vitamin C intakes, second only to discrete fruit intakes (data not shown). Fruit  
252 juice has also been highlighted as the largest contributor to vitamin C intake in older UK  
253 children's diets <sup>(16)</sup>. However fruit juice is also a source of free sugar, and limiting the  
254 consumption of free sugars is recommended for optimum health <sup>(25; 26)</sup>. The benefits of  
255 replacing fruit juice with whole fruit in terms of increasing fibre intake and decreasing energy  
256 intake have also been shown using data from children in the US <sup>(27)</sup>.

257 The association of fruit juice intake with health outcomes is also as of yet inconclusive. For  
258 example, higher intake of 100% fruit juice has been associated with higher risk of incident  
259 type 2 diabetes <sup>(5)</sup> but a null association has also been reported <sup>(28)</sup>. The associations of fruit  
260 juice intake and the risk of the metabolic syndrome and obesity <sup>(29)</sup>, and blood pressure <sup>(30)</sup>  
261 have also been investigated but there is currently insufficient evidence from which to draw  
262 conclusions.

263 100% fruit juice was a large contributor to total fruit intakes in this age-group and its  
264 contribution increased substantially with age. However, even in the oldest children, the mean  
265 intake was 77 g/d. Intakes at this level are unlikely to negatively impact on health outcomes  
266 although the rapid increase in consumption of 100% fruit juice with age may be of concern.  
267 Until a definitive conclusion is made as to the role of fruit juice in the diet, communication of  
268 the nutritional benefits of whole fruit instead of fruit juice consumption in this age-group  
269 would be pragmatic.

270 *Reporting bias*

271 The data are self-reported and are thus susceptible to reporting bias. Under-reporting food  
272 and energy intakes is of particular concern in this context as there are noted implications of  
273 under-reporting for the development of food-based dietary guidelines <sup>(31)</sup>. However as the  
274 focus in these analyses is fruit and vegetable intakes, perceived “healthy” foods, the social  
275 biases associated with food reporting are more likely to bias towards to over-reporting not  
276 under-reporting. The high level of researcher/participant interaction may have eliminated  
277 much misreporting due to forgetting foods, poor or incorrect descriptions of foods and  
278 through encouraging compliance. The use of weighed records likely reduced inaccurate  
279 estimation of portion sizes. However, researcher/participant interaction and weighing  
280 increases participant burden which can introduce its own biases.

281 *Strengths and limitations*

282 The main strengths of this study are the national representativeness of the sample, the  
283 detailed prospective dietary intake data and the comprehensiveness of the estimation of fruit  
284 and vegetable intakes. A limitation of this work is that we used the weight of all food and  
285 beverages for the weight of the total diet. This may have led to children with high intakes of  
286 liquid-like-foods and beverages having lower estimated percent contribution of fruit and  
287 vegetables to the total diet. However as there was no difference in the weight of the total diet  
288 across the four groups of level of contribution of fruit and vegetables, this was considered a  
289 justified approach.

290 *Conclusions*

291 Fruit and vegetables are important components of the diet of Irish pre-school children. They  
292 were eaten by all children, mean intakes were >4 portions per day, they contributed 20% of

293 the weight of the total pre-school diet and were important sources of dietary fibre,  $\beta$ -carotene  
294 and vitamin C. Some aspects of fruit and vegetable intakes in pre-school children could be  
295 improved and would benefit from targeted public health interventions. These include low  
296 vegetable intakes overall, increasing dependence on fruit juice with age and, very low intakes  
297 of both fruit and vegetables in a sub-group of the population.

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301 **Author Contribution**

302 LO'C conceived the research question, generated the fruit and vegetable intake data, analysed

303 the data and wrote the manuscript. JW contributed to the contents and writing of the

304 manuscript and is the study co-ordinator. AF gave critical input to the manuscript and is a

305 principal investigator of the National Pre-School Nutrition Survey. All authors approved the

306 final version of the manuscript.

307 **Conflict of Interests**

308 None



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**Table 1** Daily intake (g/day) of fruit and vegetables in Irish pre-school children aged 1-4 years (n=500)

	Total population			Consumers only			
	Mea n	Media n	S.D.	%	Mea n	Media n	S.D.
<b>All sources</b>	247	231	124	100	247	231	124
<i>Discrete vegetables</i>	32	24	30	89	35	28	30
Peas, bean & lentils	8	1	13	52	16	11	14
Onions, peppers, squashes & other vegetables	7	0	12	50	14	10	14
Carrots	7	0	11	50	14	10	13
Green vegetables (including green beans)	5	0	10	39	13	9	12
Salad vegetables	2	0	7	19	13	11	10
Tinned & jarred vegetables	1	0	4	10	11	8	9
Sweet potatoes	1	0	6	3	29	22	25
Fresh herbs	0	0	0	2	1	1	1
<i>Discrete fruit</i>	171	147	117	98	175	150	115
Fruit juices (100% juice)	51	8	78	52	98	71	84
Bananas	30	24	30	71	42	37	28
Fruit purées & smoothies (100% fruit)	22	0	44	31	69	50	53
Apples	21	12	28	62	34	26	30
Citrus fruits	11	0	22	36	31	23	29
Berries	11	0	22	37	29	21	28
Grapes	10	0	18	38	25	19	21
Kiwi, melons, pineapples, plums & other fruit	8	0	20	25	31	21	31
Pears	5	0	14	19	26	20	20
Dried fruit	3	0	6	32	10	8	7
Tinned fruit	1	0	3	6	11	11	8
<i>Vegetables in composite foods &amp; dishes</i>	26	18	25	90	29	22	24
Meat & meat products/dishes	13	7	17	67	19	14	18
Soups, sauces & miscellaneous foods	5	0	12	32	16	11	18
Vegetable dishes	3	0	10	20	17	13	17
Grains, rice, pasta & savouries	3	0	7	36	9	5	9
Fish & fish dishes	1	0	4	8	10	8	8
Breads & rolls	0	0	1	7	3	2	4
Eggs & egg dishes	0	0	1	1	8	7	5
Potato dishes	0	0	0	2	2	1	2
<i>Fruit in composite foods &amp; dishes</i>	19	9	37	98	19	9	37
Beverages	11	2	36	64	17	5	44
Fruited yoghurt	4	3	4	9	4	3	4
Confectionary & preserves	1	0	3	50	3	2	4
Fruit dishes	1	0	8	3	37	29	37
Ice-creams & chilled desserts	1	0	3	9	7	5	7
Biscuits, cakes & pastries	1	0	2	21	3	1	3
Breakfast cereals	0	0	2	13	3	1	5
Sauces	0	0	1	1	7	6	8

**Table 2** Daily intakes & sources of fruit and vegetables in Irish pre-school children aged 1-4 years by age (n=500)

		Age 1 year (n=126)	Age 2 years (n=124)	Age 3 years (n=126)	Age 4 years (n=124)	p-value*
	MDI, g/d (% contribution )					
<b>Total vegetables</b>	<b>63</b>	<b>53</b>	<b>53</b>	<b>61</b>		0.184
	<i>Discrete vegetables</i>		30 (48)	28 (53)	31 (58)	38 (62)
	<i>Vegetables in composite foods &amp; dishes</i>		33 (52)	25 (47)	22 (42)	23 (38)
<b>Total Fruit</b>	<b>151</b>	<b>185</b>	<b>209</b>	<b>213</b>		0.000
	<i>Discrete fruit</i>	84 (56)	102 (55)	105 (50)	102 (48)	0.000
	<i>100% fruit juice, smoothie, purée</i>	48 (32)	61 (33)	86 (41)	96 (45)	0.002
	<i>Fruit in composite foods &amp; dishes</i>	19 (12)	22 (12)	18 (9)	15 (7)	0.504

As  
calculated  
using  
ANOVA

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**Table 3** Contribution of fruit and vegetable intake to daily intake of key nutrients in Irish pre-school children aged 1-4 years by age (n=500)

		MDI		% contribution to total dietary intake	
		Mean	SD	Mean	SD
Total sugars	g/d	24.0	13.9	31.5	14.8
Non-milk extrinsic sugars	g/d	24.0	13.8	42.4	17.7
Dietary fibre	g/d	4.1	2.4	33.9	14.6
Potassium	mg/d	449	243	25	12
Folate	µg/d	30	23	18	12
Vitamin C	mg/d	43	35	50	26
β-carotene	µg/d	1225	1668	53	33

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## Disaggregated by age:

	Age 1 year (n=126)	Age 2 years (n=124)	Age 3 years (n=126)	Age 4 years (n=124)
	% of total diet			
Total fruit & vegetables	17.8	19.1	21.4	21.3
<i>Discrete vegetables</i>	2.5	2.2	2.5	2.9
<i>Discrete fruit</i>	11.0	13.1	15.5	15.5
<i>Vegetables in composite foods &amp; dishes</i>	2.8	2.0	1.8	1.8
<i>Fruit in composite foods &amp; dishes</i>	1.5	1.8	1.6	1.1
Remainder of diet	82.2	80.9	78.6	78.7